ND READING Assignment

makeup exam 3-6 today in my office (show up by 5)

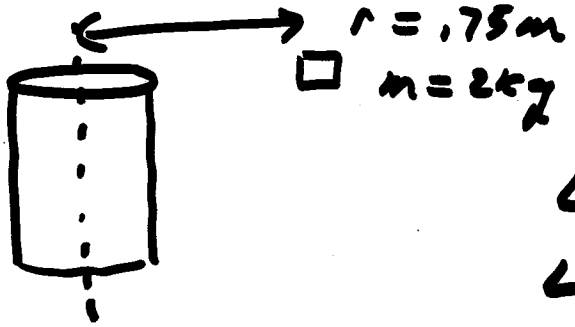
Pre Dental Club Last mtg of semester

Dale Hall 103

Thursday at 6:30

Free food from Chili's

ex) A student is sitting on a swivel seat and holding a 2kg mass in each hand. He is rotating at 1rev/s when arms outstretched .75 m from axis of rotation. What happens when he pulls in arms. Person can be approximated as a cylinder of mass 72kg and radius .25 m.



conserve angular momentum

$\Sigma L_i = \Sigma L_f$

$L_i = I_B \omega_i + 2 I_m \omega_i$

$L_f = I_B \omega_f + \underbrace{0}_{r=0,\ I=0}$

$(I_B + 2I_m)\omega_i = I_B \omega_f$

$I = \Sigma m r^2$

$\left(\frac{1}{2}MR^2 + 2 \cdot mr^2\right)\omega_i = \frac{1}{2}mR^2\omega_f$

$$\omega_f = \left(\frac{\frac{1}{2}MR^2 + 2mr^2}{\frac{1}{2}MR^2}\right)\omega_i$$

$$\omega_f = \left(\frac{\frac{1}{2}(72kg)(.25m)^2 + 2\cdot(2kg)(.75m)^2}{\frac{1}{2}(72kg)(.25m)^2}\right) \cdot 1 rev/s$$

$$\boxed{\omega_f = 2.8\ rev/s}$$

Equilibrium

object at rest is an example

Forces are balanced so no acceleration and no angular acceleration

→ Constant velocity ($\vec{v}=0$)
→ Constant angular velocity ($\omega=0$)

If an object is not moving ($\vec{v}=0$) / rotating ($\omega=0$) it is in equilibrium

→ $\Sigma \vec{F} = m\vec{a}$ $\Sigma \tau = I\alpha$

$\vec{a}=0$ $\alpha=0$

$\Sigma \vec{F}=0$ (Done this before)

$\Sigma \tau=0$ (new)

$\Sigma \tau = \Sigma rF\sin\theta = 0$

Note Torque can be measured relative to any axis

ex) A uniform 40 N Board supports 2 children weighing 500 N and 350 N. A support is under center of mass of board. The 500 N child is 1.5 m from center.

a) what is Force that support exerts

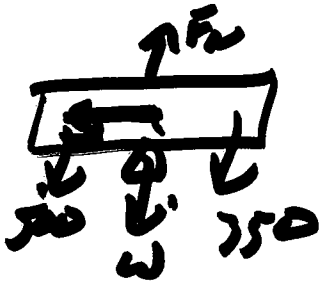
b) where should 350 N child sit to balance board?

$$\Sigma F_y = 0$$

$$F_N - 500\,N - 40\,N - 350\,N = 0$$

$$\boxed{F_N = 890\,N}$$

$\Sigma \tau = 0$



Choose support as axis

$+(500N \cdot 1.5m) \cdot \sin 90^\circ$

0 (support) $r = 0$

$-(350N \cdot r) \sin 90^\circ = 0$

$500N \cdot 1.5m - 350N \cdot r = 0$

$r = 2.14$ m from support

Choose 500N child as axis

$\Sigma \tau = 0$

0 500N child $r = 0$

$-40N \cdot 1.5m \cdot \sin 90^\circ$

$-350N \cdot r \cdot \sin 90^\circ$

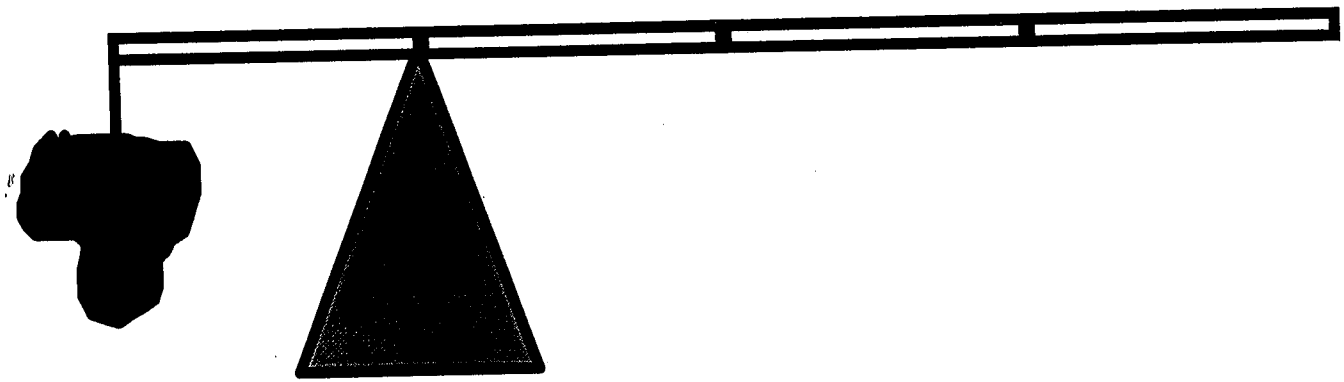
$+890N \cdot 1.5m \cdot \sin 90^\circ = 0$

$r = 3.64$ m from 500N child

$3.64 - 1.5m =$ 2.14 m from support

Interactive Question

A 1-kg rock is suspended by a massless string from one end of a 1-m measuring stick. What is the weight of the measuring stick if it is balanced by a support force at the 0.25-m mark?



A) 0.25 kg

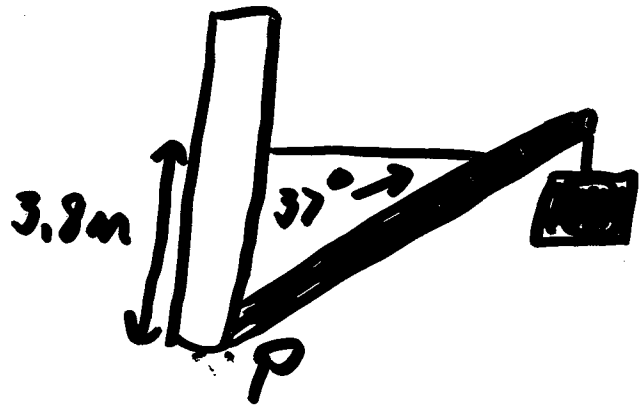
B) 0.5 kg

C) 1kg

D) 2 kg

E) 3kg

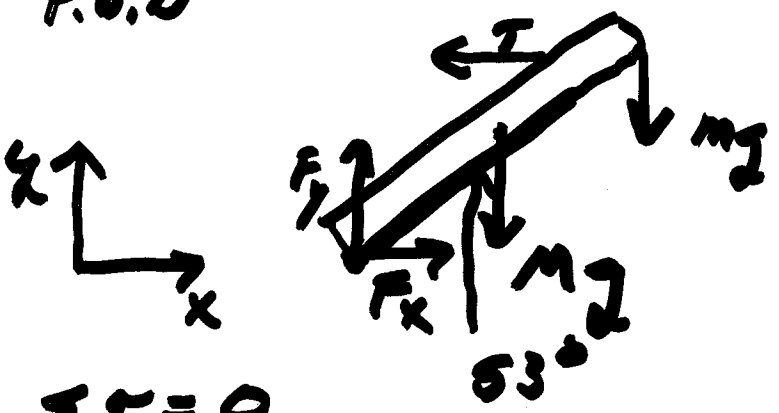
ex) A Traffic light hangs as shown

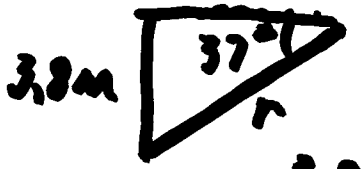


Pole 7.5m long (L)
Pole mass 8.0kg (M)
light mass 11kg (m)

Determine Tension in cable and Vertical and horizontal components of force on the pivot point P

F.B.D





$\sin 37° = \frac{3.8m}{r}$

$3.8m = r \sin 37°$

$\Sigma \tau = 0$

$-Mg\left(\frac{L}{2}\right)\sin 53° - mgL\sin 53° + T\frac{r\sin 37°}{3.8m} = 0$

$T = 230N$

$\Sigma F_x = 0 \quad F_x - T = 0 \quad F_x = T \quad \boxed{230N}$

$\Sigma F_y = 0 \quad F_y - Mg - mg = 0$

$F_y = Mg + mg = \boxed{190N}$